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South Dakota Fertilizer Experiments 1955

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SOUTH DAKOTA FERTILIZER EXPERIMENTS 1955

Agricultural Experiment Station
South Dakota State College
Brookings, South Dakota

stories of dry weather

SOUTH DAKOTA FERTILIZER EXPERIMENTS 1955

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The fertilizer experiments reported in this summary were conducted in 16 counties in South Dakota. These experiments were located on representative soil types and were conducted in the major crop areas of the state.

The objectives of these experiments were to:

1. Determine optimum fertilizer rates and ratios.
2. Compare the effect on yield of fall application to spring application.
3. Evaluate two methods of application on the yield of small grains.
4. Appraise the influence of soil types and previous management on fertilizer response.
5. Ascertain the residual effects of commercial fertilizer.

The growing season in 1955 was characterized by above normal temperatures and below normal rainfall. At the beginning of the season the subsoil moisture was about normal for most of the state. The effectiveness of the crop season rainfall, however, was reduced by excessive evaporation due to strong winds and high temperatures. Small grains were injured especially by the May drought which placed a ceiling on final yields in most areas. Associated with the dry climatic conditions, however, was the lower incidence of plant diseases which had a beneficial effect on crop quality.

The corn yields in most areas were reduced by high temperatures and drought occurring in late July and August.

The use of fertilizer is an important factor for increasing the yields of crops, but frequently other factors limit the effectiveness of its use. Some of the more prevalent limiting factors are; adverse climatic conditions, unadapted varieties, prevalence of plant diseases, and undesirable cultural practices. The type of soil and past management practices - especially those related to fertility maintenance - also have a pronounced effect on fertilizer responses.

Information from the experiments presented in this report deals only with the principles of fertilizer application and is intended to serve as a guide for more efficient use of commercial fertilizers.

Unless otherwise explained by a footnote, nitrogen was applied in the form of ammonium nitrate, phosphorus as treble super phosphate and potassium as muriate of potash in the following experiments.

FERTILIZER EXPERIMENTS
ON SMALL GRAIN
1955

Table 1. Effect of Fertilizer on Yield of Barley in Brookings Co.
Yield in bushels per acre

Treatment Pounds per acre N	P_2O_5	K_2O	Trent Silt loam
0	0	0	41.4
40	0	0	47.2
0	40	0	45.1
20	40	0	49.8
40	40	0	56.2
60	40	0	60.9
40	20	0	52.3
40	60	0	59.1
L. S. D. at 5% level			6.2

not necessary to include

Objective of experiment

Determine effect of previous crop of soybeans on fertilizer response of barley.

Description of soil and location

1. Brookings County

(a) Trent silt loam - a moderately well drained soil developed in loess on nearly level topography.

Cropping history and previous management

Soybeans preceded the barley experiment. The fertilizer was applied by broadcasting on the surface after the barley was planted and the fertilizer was not worked into the soil.

Discussion and interpretation of results

The yield of the barley crop, following soybeans, was substantially increased by commercial fertilizer. The barley crop required approximately 40 pounds of nitrogen with phosphorus for obtaining close to maximum yields. Note that the yields are relatively high for the 1955 crop year. This is due to the more favorable moisture relationship on this moderately well drained soil.

Table 2. Effect of Fertilizer on Yield of Wheat in Day County
Yield in bushels per acre

Treatment Pounds per acre N	P_2O_5	K_2O	Sinai silt loam
0	0	0	31.3
40	0	0	31.8
0	40	0	33.4
20	40	0	31.1
40	40	0	33.2
60	40	0	33.0
40	20	0	33.2
40	60	0	31.8
L.S.D. at 5% level			5.1

Harold Vehe
written

Objective of experiment

Determine response of wheat to fertilizer treatments on Sinai silt loam located on the Prairie Coteau in north eastern South Dakota.

Description of soil and location

Sinai silt loam - derived from water reworked glacial deposits.

Cropping history and previous management

1944-1949 - Crested wheat and brome grass pasture.

1950 - Wheat

1951 - Barley

1952 - Flax

1953 - Wheat

1954 - Barley

Discussion and interpretation of results

There was no significant increase in yield due to fertilizer treatments.

The residual fertility from five years of meadow and pasture was sufficient to maintain the highest yield possible under the 1955 weather conditions.

Table 3. Effect of Time of Fertilizer Application on Yield of Small Grains in East Central South Dakota, 1955

Yields in bushels per acre

Time of Application	Treatment pounds per acre *N	P_2O_5	K_2O	Barley Brookings Co. Kranzburg silt loam	Barley Brookings Co. Maddock loamy sand	Wheat Brookings Co. Barnes loam
Spring	0	40	0	38.2	44.4	18.9
Fall	0	40	0	41.6	39.8	17.7
Spring	20	40	0	39.7	44.9	25.4
Fall	20	40	0	38.2	44.6	24.8
Spring	40	40	0	41.5	49.9	31.6
Fall	40	40	0	40.1	44.2	31.0
Spring	60	40	0	41.2	44.3	35.1
Fall	60	40	0	39.2	42.1	31.8
L.S.D. at 5% level to measure differences between fertilizer ratios				not significant	not significant	3.6

Objectives of experiments

1. Compare effects of fall application to spring application.

2. Compare yield results from different fertilizer ratios.

Description of soils and location

1. Brookings Co.

   (a) Kranzburg silt loam - a well drained upland soil developed from wind laid silts.

   (b) Maddock loamy sand - a somewhat excessively drained soil developed from sands overlying glacial till.

   (c) Barnes loam - a well drained upland soil developed from glacial till.

Cropping history and management

The cropping history on all the above locations was small grains and corn with very limited use of legumes, manure or commercial fertilizer.

Discussion and interpretation of results

On the Kranzburg silt loam there was no significant yield differences due to fertilizer rates or ratios, or to time of application. In previous years under

*Nitrogen was applied in the form of urea

more desirable weather conditions, this soil has responded to fertilizer treatments.

On the Maddock soil the fertilizer was applied on fall plowing. There appeared to be an advantage in favor of spring application, however, this sandy soil is easily eroded by wind action, therefore, the apparent yield advantage may be due to the loss of fertilizer by erosion from the fall applications. Climatic conditions in 1955 limited the degree of response to fertilizer on the barley experiments.

Fertilizer treatments gave highly significant wheat yield increases on the Barnes loam experiment. The time of application (fall or spring) had little or no influence on yield.

Table 4. Effect of Time of Fertilizer Application on Yield of Small Grains in South Eastern South Dakota, 1955

Yield in bushels per acre

Time of application	Treatment pounds per acre *N	P_2O_5	K_2O	Oats Lincoln Co. Trent silty clay loam
Spring	0	60	0	47.0
Fall	0	60	0	45.8
Spring	40	60	0	45.6
Fall	40	60	0	50.9
Spring	60	60	0	58.2
Fall	60	60	0	58.4
Spring	80	60	0	55.4
Fall	80	60	0	49.3
L.S.D. at 5% confidence level to measure differences between fertilizer ratios.				11.8

Objectives of experiment

1. Compare effects of fall application to spring application on oats yields.

2. Compare yield results from different fertilizer ratios.

Description of soil and location

1. Lincoln Co.

   (a) Trent silty clay loam - a moderately well drained soil developed from loess.

* Nitrogen was applied in the form of urea.

Cropping history and management

This soil has been continucusly cropped to corn and small grain with no manure, fertilizer or legumes used in the last 8 to 10 years.

Discussion and interpretation of results

There appeared to be a response to nitrogen but it was masked by the spring drouth.

The time of application had no decided effect on yields.

Table 5. Effect of Time of Fertilizer Application on Yield of Oats in South Central South Dakota, 1955

Treatment Pounds per acre			Yields in bushels per acre					
			Location 1 Gregory Co. Boyd silty clay loam		Location 2 Gregory Co. Boyd silty clay loam		Location 3 Gregory Co. Holt silt loam	
N	P_2O_5	K_2O	Fall	Spring	Fall	Spring	Fall	Spring
0	0	0	33.3	33.3	43.3	43.3	34.1	34.1
40	0	0	46.4	63.8	53.8	51.6	38.6	39.9
40	40	0	44.7	64.7	56.3	61.4	43.4	44.6
L.S.D. at 5% confidence level			5.6		6.8		6.8	

Objective of Experiment

To determine the relative effectiveness of spring versus fall application of fertilizer on yield of oats.

Description of soils and location

1. Gregory Co. (Locations 1 and 2)

   (a) Boyd silty clay loam - a silty clay loam surface overlying clay shale.

2. Gregory Co. (Location 3)

   (a) Holt silt loam - a well drained upland soil developed from calcareous sandstone.

Cropping history and past management

Soil depleting rotations were used on all 3 locations.

Discussion and interpretation of results

On Location 1 the spring application of fertilizer appeared to produce higher yields than the fall application, but there is a strong probability that the fall applied fertilizer was partially lost through wind erosion. The ground was tilled with a wheatland plow in fall before the fertilizer was applied, and there was very little protective cover.

On Locations 2 and 3 there were no significant differences due to time of fertilizer application.

Table 6. Effect of Time of Fertilizer Application on Yield of Barley in Western South Dakota, 1955

Yields in bushels per acre

Treatment pounds per acre N	P_2O_5	K_2O	Meade Co. Cheyenne loam Fall	Spring
0	0	0	10.7	10.7
40	0	0	23.0	23.1
40	40	0	22.8	26.9
L.S.D. at 5% level to compare fertilizer ratios			2.9	

Objectives of experiment

To determine the relative efficiency of fertilizer applied in the spring to fertilizer applied in the fall.

Description of soils and location

1. Meade Co.

(a) Cheyenne loam - a high terrace soil consisting of a loam surface overlying sands and gravel.

Cropping history and past management

Continuous row crops and small grains were grown at this location.

Discussion and interpretation of results

There was a good response to nitrogen but no real differences due to time of application.

Table 7. Response of Oats to Fertilizer Treatments and Methods of Application in eastern South Dakota, 1955

Treatment pounds per acre N	P_2O_5	K_2O	Yield in bushels per acre: Brookings Co. Lamoure Silty clay loam Fertilizer broadcast	Brookings Co. Lamoure Silty clay loam Fertilizer drilled	Brookings Co. Fordville loam Fertilizer broadcast	Brookings Co. Fordville loam Fertilizer drilled
0	0	0	31.8	38.2	25.3	24.9
40	0	0	38.9	35.2	26.4	24.6
0	40	0	42.4	45.0	32.5	33.6
0	0	60	33.0	32.7	25.8	26.0
20	40	0	45.4	47.4	38.8	34.5
40	40	0	54.4	57.3	29.5	34.8
60	40	0	52.8	55.5	31.1	30.7
40	60	0	60.4	62.1	31.0	32.8
40	20	0	48.0	52.6	27.6	34.2
40	40	60	50.9	51.6	29.7	36.3
Average yield			45.8	47.8	29.8	31.2
L.S.D. at the 5% level for comparing yields of individual fertilizer treatments.			6.8	5.9	4.9	6.3

Objective of experiments

1. To determine the effect of various rates and combinations of nitrogen, phosphorus and potash on yields of oats.
2. To determine the efficiency of drilling fertilizer with the seed, compared to the broadcast method.

Description of soils and location

1. Brookings Co.
   (a) Lamoure silty clay loam - a somewhat poorly drained soil on the Sioux River bottom developed from fine textured alluvium. The surface soil is thick and dark in color with free lime occurring at the surface.
   (b) Fordville loam - a well drained terrace soil developed in wind modified alluvium overlying gravel on nearly level topography.

Cropping history and previous management

A cropping sequence of corn and small grain was followed with very limited utilization of soil building practices as the use of legumes, manure and fertilizer.

Discussion and interpretation of results

The Fordville loam gave a substantial increase in oats yield to phosphate applied alone. Nitrogen alone or potash alone gave no appreciable increase in yield. The comparatively low yields in this experiment were due to the droughty nature of the soil (gravel substrata) and to the adverse weather conditions. Drilling the fertilizer with the seed gave about the same yield as the broadcast method.

The Lamoure silty clay loam also gave a substantial increase in oat yield to phosphate alone. The combination of nitrogen and phosphorus resulted in greater yield increases than phosphorus applied alone. The addition of potash to the N P treatment gave no additional increase in yield. There was a small but rather consistent advantage for drilling the fertilizer with the seed.

Table 8. Response of Oats to Fertilizer Treatments and Methods of Application in Central South Dakota, 1955.

Treatment pounds per acre N	P_2O_5	K_2O	Yield in bushels per acre: Agar silt loam, Hand Co. Moderately deep over till Fertilizer broadcast	Fertilizer drilled	Aurora Co. Sölonetz Complex soil Fertilizer broadcast	Fertilizer drilled
0	0	0	41.6	42.1	38.4	40.9
40	0	0	44.1	44.5	60.3	56.6
0	40	0	40.3	46.6	49.5	44.5
0	0	60	43.5	41.1	47.0	45.0
20	40	0	61.2	70.3	54.3	49.3
40	40	0	52.5	64.1	59.6	65.1
60	40	0	50.1	63.1	60.4	60.8
40	60	0	56.5	69.2	61.0	62.3
40	20	0	57.2	64.7	58.7	62.2
40	40	60	56.6	64.4	56.2	61.8
Average			50.4	57.0	54.5	54.9
L.S.D. at 5% level for comparing yields of individual fertilizer treatments			9.7	8.8	11.4	9.6

Objectives of experiments

1. To determine the effect of various rates and combinations of nitrogen, phosphorus and potash on yields of oats.
2. To determine the efficiency of drilling fertilizer with the seed compared to the broadcast method.

Description of soils and location

1. Hand County

(a) Agar silt loam moderately deep over till - a well drained upland soil developed from shallow loess overlying glacial till.

2. Aurora County

(a) Solonetz complex soil - a somewhat poorly drained claypan soil derived from glacial till.

Cropping history and previous management

The cropping history on both locations was largely corn and small grain with very limited use of legumes and manure.

Discussion and interpretation of results

On the Agar silt loam combinations of nitrogen and phosphorus gave the largest yields. Drilling the fertilizer with the seed gave significantly higher yields than the broadcast method. This soil gave similar results to method of application for two successive years.

The Solonetz complex gave a decided response to nitrogen similar to that of 1954. There was no consistant response to phosphorus either alone or in combination with nitrogen. There was no difference in yield due to method of fertilizer application.

Table 9. Effect of Fertilizer on Yields of Oats in South Central South Dakota, 1955

Treatment Pounds per Acre			Yield in bushels per acre					
			Location 1	Location 2	Location 3	Location 4	Location 5	Location 6
			Gregory Co.	Gregory Co	Gregory Co	Gregory Co	Gregory Co	Aurora Co
			Holt	Hold	Boyd	Boyd	Boyd	Bonilla
N	P_2O_5	K_2O	loam	silt loam	silty clay loam	silty clay loam	silty clay loam	silty clay loam
0	0	0	25.8	34.1	33.3	38.2	43.3	38.4
40	0	0	26.2	39.9	63.8	37.4	51.6	50.6
0	40	0	34.8	34.7	32.5	45.3	45.0	43.3
20	40	0	29.9	38.5	53.7	49.5	54.5	55.7
40	40	0	23.4	44.6	64.7	51.2	61.4	50.8
60	40	0	28.5	45.0	71.6	48.2	58.5	55.9
40	60	0	31.3	45.4	69.8	52.6	50.1	51.7
40	20	0	26.5	39.7	62.3	47.4	61.8	57.6
L.S.D. at 5% confidence level			N.S.	6.8	5.6	8.5	6.1	N.S.

Objectives of experiments

Determine optimum fertilizer rates and ratios for oats on representative soils in south central South Dakota.

Description of soils and location

(1) Gregory County

(a) Holt - a well drained upland soil developed from calcareous sandstone.

(b) Boyd - well drained upland silty clay loam surface soil overlying clay shale.

(c) Bonilla - moderately well drained soil developed from glacial till.

Cropping history and past management

The cropping history on all the above locations was largely small grain alternated with corn or sorghum. Limited use was made of legumes, manure and commercial fertilizer.

Discussion and interpretation of results

Location 1. Adequate nitrogen was supplied by the preceeding sweet clover catch crop. This plot was weedy and the stand was poor because of the dry weather conditions at planting time.

Location 2. There was a significant response to nitrogen and phosphate applied together but the yields were relatively low due to the very poor stand.

Location 3. There was a highly significant response due primarily to nitrogen. The stand was excellent because of good seedbed preparation and moisture conservation.

Locations 4, 5, and 6. There were appreciable yield responses to combinations of nitrogen and phosphorus but the yields were limited and variable due to soil and climatic factors.

Table 10. Effect of Fertilizer on Yields of Barley in Western South Dakota, 1955

Yield in bushels per acre

Treatment Pounds per acre N	P_2O_5	K_2O	Meade Co. Cheyenne silt loam	Meade Co. Cheyenne loam	Lawrence Co. (no series name) silt loam	Dewey Co. Rhoades Regent Association clay loam
0	0	0	5.6	10.7	32.1	19.3
40	0	0	5.6	23.1	31.2	18.1
0	40	0	7.1	9.2	35.9	16.7
20	40	0	8.1	22.0	33.7	19.3
40	40	0	6.1	26.9	34.6	17.9
60	40	0	5.8	27.5	29.2	20.3
40	60	0	6.1	22.8	32.7	19.6
40	20	0	5.8	20.3	29.1	20.8
0	0	60	--	--	--	20.6
40	40	60	--	--	--	19.7
L.S.D. at 5% confidence level			N.S.	2.9	N.S.	N.S.

Objectives of experiments

Determine optimum fertilizer rates and ratios for barley on representative soil types in western South Dakota.

Description of soils and location

(1) Meade Co.

(a) Cheyenne silt loam - a high terrace soil consisting of silt loams overlying sands and gravel.

(b) Cheyenne loam - same as above except for texture of surface soil.

(2) Lawrence Co.

(a) No series name has been given to this soil. It is a residual soil with a silt loam surface developed from sandy limestone.

(3) Dewey Co.

(a) Rhoades-Regent Association - Rhoades is a scabby soil with a compact subsoil located in basins. Regent soils developed from clay loam shales.

Cropping history and past management

All the above locations had been under continuous cropping without the use of any fertility improvement practices.

Discussion and interpretation of results

On the Cheyenne silt loam the barley suffered from severe heat and drought. The crop never attained a height of over 10 to 12 inches. There was no beneficial or detrimental effect from use of fertilizer.

Nitrogen fertilizer on the Cheyenne loam increased the yield approximately ten bushels per acre.

The experiment in Lawrence Co. had comparatively good yields. The lack of response was due to premature ripening of the crop caused by high July temperatures.

There was no significant fertilizer response on the Rhoades Regent Association.

Table 11. Effect of Fertilizer on Yields of Spring Wheat in Western South Dakota, 1955

Treatment Pounds per acre N	P_2O_5	K_2O	Yield in bushels per acre Tripp County Pierre clay	Lawrence County Spearfish silt loam	Dewey Co. Morton silt loam	Dewey Co. Morton clay loam	Dewey Co. Promise-Hurley Clay Complex
0	0	0	5.4	9.1	14.7	12.1	10.1
40	0	0	5.3	8.5	12.3	10.8	7.9
0	40	0	5.7	8.7	12.2	9.3	9.8
20	40	0	6.5	9.3	11.5	10.7	8.7
40	40	0	6.7	8.9	14.6	10.1	8.1
60	40	0	5.5	9.5	13.6	10.8	8.6
40	60	0	6.7	8.7	15.4	12.9	6.5
40	20	0	5.7	9.3	15.2	12.8	6.2
0	0	40	-	-	13.2	9.5	8.6
40	40	40	-	-	14.4	11.7	9.1
L.S.D. at 5% confidence level			N.S.	N.S.	N.S.	N.S.	N.S.

Objectives of experiments

Determine fertilizer response of spring wheat on representative soil types in western South Dakota.

Description of soils and location

(1) Tripp Co.

(a) Pierre Clay - Gently undulating clay soil over Pierre shale.

(2) Lawrence Co.

(a) Spearfish silt loam - very steep south slope (15%), silt loam surface soil derived from Spearfish Redbeds.

(3) Dewey Co.

(a) Morton silt loam - Silt loam surface soil overlying clay loam shale.

(b) Morton clay loam - Clay loam surface soil overlying clay loam shale.

(c) Promise Hurley clay complex - wind deposited clay sediments over clay shale, intermingled with areas underlain with claypan.

Cropping history and past management

The Spearfish silt loam in Lawrence County had a 4 year old alfalfa sod plowed under 2 years prior to the experiment.

The other locations had been under continuous cropping for the last 7 or more years with very limited use of any fertility improvement practices.

Discussion and interpretation of results

Fertilizer failed to give a significant increase or decrease in yield on any of the locations.

Adverse climatic conditions restricted yields.

Table 12. Effect of Fertilizer on Yields of Winter Wheat in Western South Dakota, 1955

Yields in bushels per acre

Treatment Pounds per acre N	P_2O_5	K_2O	Gregory County Boyd Silty clay	Tripp County Presho silty Clay loam	Haakon County Promise Silty clay	Pennington County Cheyenne loam
0	0	0	12.3	24.0	37.9	5.8
40	0	0	11.5	22.0	40.6	3.8
0	40	0	12.0	24.1	38.8	6.3
20	40	0	10.3	21.2	40.0	5.2
40	40	0	12.5	22.9	39.7	4.5
60	40	0	13.4	21.3	40.3	3.2
40	60	0	11.9	27.8	38.2	3.8
40	20	0	9.5	21.6	36.2	3.8
L.S.D. at 5% confidence level			N.S.	N.S.	N.S.	1.3

Objectives of experiments

Determine fertilizer response of winter wheat on representative soil types in western South Dakota.

Description of soils and location

(1) Gregory County

(a) Boyd silty clay - silty clay surface soil overlying clay shale occurring on slightly undulating topography.

(2) Tripp County

(a) Presho silty clay loam - developed from silty clay and clay wind deposited sediments.

(3) Haakon County

(a) Promise silty clay - developed from silty clay and clay wind deposited sediments overlying clay shale.

(4) Pennington County

(a) Cheyenne loam - a high terrace soil consisting of loam surface soil overlying sands and gravel.

Cropping history and past management

In Haakon County the experimental plot followed summer fallow. The other locations had been under continuous cropping without the use of fertility improvement practices.

Discussion and interpretation of results

There was no appreciable fertilizer response at any of the locations.

Yields were reduced on the Boyd silt loam plots because of hail damage.

There was no response on the Presho silty clay loam.

The Promise silty clay plots followed summer fallow. Yields were high because of the increased nitrogen and moisture made available by the fallow.

Yields were very low on the Cheyenne loam because of drought.

Table 13. Effect of Fertilizer on Yields of Rye in South Central South Dakota, 1955

Treatment Pounds per acre N	P_2O_5	K_2O	Yields in bushels per acre Tripp Co. Presho silty clay loam	Aurora Co. Bonilla silty clay loam	Aurora Co. Solonetz complex silty clay loam
0	0	0	9.6	41.5	16.9
40	0	0	8.1	41.3	28.0
0	40	0	10.1	39.3	15.2
20	40	0	10.2	44.4	24.6
40	40	0	10.4	43.6	29.4
60	40	0	9.6	43.3	29.0
40	60	0	10.5	44.4	29.4
40	20	0	10.4	43.0	28.1
L.S.D. at 5% confidence level			N.S.	N.S.	5.0

Objective of experiments

Determine the fertilizer response of rye in south central South Dakota.

Description of soils and location

1. Tripp Co.

   (a) Presho silty clay loam - developed from silty clay and clay wind deposited sediments.

2. Aurora Co.

   (a) Bonilla silty clay loam - a moderately well drained soil developed from glacial till.

   (b) Solonetz complex - a somewhat poorly drained claypan soil derived from glacial till.

Cropping history and past management

The experiment on the Bonilla silty clay loam followed summer fallow. The other two locations were continuously cropped to row crop and small grain with limited use of fertility improving practices.

Discussion and interpretation of results

Poor fall germination and lack of early spring moisture reduced the yield potential on the Presho soil.

The nitrogen requirements were satisified by the release of available nitrogen by the fallow treatment on the Bonilla silty clay location.

The fertilizer was top dressed in very early spring on the Solonetz soil. There was a strong response to nitrogen.

Table 14. Residual Effect of Fertilizer on Oats in Turner Co., 1955

Treatments pounds per acre N	P_2O_5	K_2O	Source of nitrogen	Yield bushels per acre
0	0	0	none	38.0
40	0	0	anhydrous ammonia	40.2
40	0	0	ammonium nitrate	35.9
40	40	0	ammonium nitrate	40.9
80	0	0	anhydrous ammonia	43.3
80	0	0	ammonium nitrate	41.3
80	40	0	anhydrous ammonia	45.3
80	40	0	ammonium nitrate	40.2
80	40	0	Urea	44.8
L.S.D. at 5% confidence level				N.S.

Objective of experiment

Determine residual effect of nitrogen and the effect of different nitrogen carriers on the second crop after application.

Description of soil and location

1. Turner Co. - south eastern South Dakota

(a) Barnes silt loam - well drained soil developed from glacial till.

Cropping history and previous management

In 1954 the solid fertilizer was broadcasted on plowed ground in the spring before corn planting. The anhydrous ammonia was applied at the same time with a conventional applicator. In 1955 this field was planted to oats and no additional fertilizer was applied.

Discussion and interpretation of results

There appeared to be some yield increases due to the residual effect of nitrogen but the increases were not large enough to be of positive significance. The residual effect was masked to some extent by the spring drouth.

Table 15. Residual Effect of Fertilizer on Oats in Brookings Co., 1955

Treatment pounds per acre N	P_2O_5	K_2O	Brookings County Lamoure silty clay loam bushels per acre
0	0	0	40.6
40	0	0	42.9
0	40	0	45.1
0	0	60	36.2
20	40	0	47.0
40	40	0	56.4
60	40	0	55.9
40	60	0	61.8
40	20	0	45.9
40	40	60	45.2
L.S.D. at 5% Confidence level			9.1

Objective of experiment

To determine residual effect of fertilizer on the second crop after application.

Description of soil and location

1. Brookings Co.

(a) Lamoure silty clay loam - a somewhat poorly drained soil on the Sioux River bottom developed from fine textured alluvium. Free lime occurs at the surface.

Cropping history and previous management

The cropping system was largely corn and small grain with very limited use of fertility building practices.

Discussion and interpretation of results

The fertilizer was applied on the preceding corn crop in 1954. No additional fertilizer was used on the oats crop in 1955.

There was a significant response to the residual fertilizer. Nitrogen alone was not effective in increasing yields because this soil is calcareous at the surface and for this reason was deficient in available phosphorus. The residual effect of nitrogen could not be expressed in terms of yield increases until the phosphate requirements were fulfilled. Therefore combinations of nitrogen and phosphorus had the greatest residual effect.

FERTILIZER EXPERIMENTS
ON GRASS
1955

Table 16. Effect of Fertilizer on Yield of Hay and Grass Seed

Treatments pounds per acre N	P_2O_5	K_2O	Haakon Co. Promise silty clay Crested wheat Seed lbs./A.	Haakon Co. Promise silty clay Crested wheat Forage lbs./A.	Meade Co. Cheyenne loam Ree wheat Seed lbs./A.	Meade Co. Cheyenne loam Ree wheat Forage lbs./A.
0	0	0	53.4	939.0	296.0	4037.0
20	0	0	142.7	1518.0	308.0	4179.0
40	0	0	171.5	1899.0	292.0	4467.0
80	0	0	165.0	2040.0	298.0	4084.0
40	40	0	163.1	1977.0	281.0	3767.0
L.S.D. at 5% level			46.2	425.0	N.S.	N.S.

Objectives of experiments

Determine response of tame grass to fertilizer in western South Dakota.

Description of soils and location

1. Haakon Co.

   (a) Promise silty clay - developed from silty clay and clay wind deposited sediments overlying clay shale.

2. Meade Co.

   (a) Cheyenne loam - a terrace soil consisting of a loam surface soil overlying sand and gravel.

Cropping history and previous management

In Haakon Co. the experiment was on an old stand of crested wheatgrass. In Meade Co. the stand of Ree wheatgrass was two years old.

Discussion and interpretation of results

On the old stand of crested wheat in Haakon Co. there was a good response to nitrogen in both seed and forage.

On the new stand of Ree wheatgrass in Meade Co. there was still enough nitrogen and phosphorus in the soil to supply the needs of the crop.

FERTILIZER EXPERIMENTS
ON CORN
1955

Table 17. Effect of Time of Fertilizer Application on Corn

Yields in bushels per acre

Time of Application	Treatment pounds per acre N	P_2O_5	K_2O	Brookings Co. Kranzburg silt loam	Turner Co. Kranzburg silt loam
Spring	0	60	0	58.2	47.0
Fall	0	60	0	57.5	50.0
Spring	40	60	0	59.3	49.5
Fall	40	60	0	56.8	53.9
Spring	60	60	0	55.9	49.7
Fall	60	60	0	54.5	49.2
Spring	80	60	0	56.2	48.5
Fall	80	60	0	56.9	48.8
L.S.D. at 5% Confidence level				N.S.	N.S.

Objectives of experiments

1. Determine yield response of corn to different fertilizer ratios.
2. Compare results of spring application to fall application.

Description of soils and location

1. Brookings Co. and Turner Co.
   (a) Kranzburg silt loam - well drained upland soil developed from loess overlying glacial till.

Cropping history and previous management

Principally corn and small grain with very limited use of soil improvement practices.

Discussion and interpretation of results

There were no significant yield increases at the 5% Confidence level, and essentially no differences due to time of application.

Table 18. Effect of Fertilizer on Yield of Corn in South Eastern South Dakota, 1955

Treatment pounds per acre N	P_2O_5	K_2O	Yields in bushels per acre Union Co. Crofton silt loam	Bon Homme Co. Houdek loam	Turner Co. Kranzburg loam	Aurora Co. Solonetz complex silty clay loam
0	0	0	22.4	64.1	46.2	15.4
20	40	0	36.9	69.4	38.0	18.2
40	40	0	40.1	69.9	38.4	13.4
60	40	0	39.0	67.8	44.1	18.9
120	40	0	40.1	65.8	44.1	--
40	0	0	29.8	66.9	40.6	18.9
0	40	0	--	--	--	19.2
40	20	0	--	--	--	25.5
40	60	0	--	--	--	25.3
L.S.D. at 5% Confidence level			7.7	N.S.	N.S.	N.S.

Objectives of experiments

Determine fertilizer response of corn on representative soil types in South Eastern South Dakota.

Description of soils and locations

1. Union Co.

   (a) Crofton silt loam - a severely eroded soil developed from loess on steeply rolling topography.

2. Bon Homme Co.

   (a) Houdek loam - a well drained upland soil developed from glacial till occuring on gently undulating topography.

3. Turner Co.

   (a) Kranzburg loam - well drained upland soil develcped from loess.

4. Aurora Co.

(a) Solonetz complex, silty clay loam - a somewhat poorly drained clay pan soil derived from glacial till.

Cropping history and previous management

The cropping history on all the above locations was largely corn and small grains with very limited use of fertility improvement practices.

Discussion and interpretation of results

On the Crofton silt loam there was a pronounced increase in yield due to fertilizer treatments. Large yield responses were obtained from the application of nitrogen and phosphorus combinations. The eroded condition of this soil was responsible for the low level of nitrogen and phosphorus fertility.

The fertility level on the other locations was sufficiently high to permit maximum yields of corn for the climatic conditions that occurred in the respective areas

Table 19. Effect of Fertilizer on Yield of Corn in East Central and North Eastern South Dakota
1955

Treatment pounds per acre			Yields in bushels per acre		
N	P_2O_5	K_2O	Brookings Co. Lamoure silty clay loam	Roberts Co. Barnes loam	Roberts Co. Barnes silt loam
0	0	0	50.4	52.8	63.4
20	40	0	--	--	62.7
40	40	0	53.9	56.4	67.3
60	40	0	--	--	65.3
120	40	0	--	--	66.5
40	0	0	54.4	56.7	68.1
40	40	20	55.9	60.1	--
40	20	40	56.6	57.2	--
40	40	40	56.5	59.1	--
40	40	80	53.3	51.3	--
40	80	40	55.4	57.9	--
L.S.D. at 5% Confidence level			N.S.	N.S.	N.S.

Objectives of experiments

Determine fertilizer response of corn on representative soil types in east central and north eastern South Dakota.

Description of soils and locations

1. Brookings Co.

   (a) Lamoure silty clay loam - a somewhat poorly drained soil developed on flood plains from fine textured alluvium.

2. Roberts Co.

(a) Barnes loams and silt loams - well drained upland soils developed from glacial till.

Cropping history and past management

The cropping history on all the above locations was largely corn and small grains with very limited use of soil improvement practices.

Discussion and interpretation of results

No significant responses were obtained at the 5% confidence level.

Table 20. Effect of Fertilizer on Yield of Corn in South Central South Dakota, 1955

Treatment Pounds Per Acre			Yields in bushels per acre	
			Location 1	Location 2
			Gregory Co.	Gregory Co.
N	P_2O_5	K_2O	Boyd silty clay loam	Boyd silty clay loam
0	0	0	28.6	30.2
20	40	0	32.2	28.2
40	40	0	34.6	29.4
60	40	0	31.2	35.6
120	40	0	36.5	—
40	0	0	30.2	31.1
0	40	0	—	27.0
40	20	0	—	28.6
40	60	0	—	33.7
L.S.D. at 5% Confidence level			N.S.	N.S.

Objectives of experiments

Determine fertilizer response of corn on representative soil types in south central South Dakota.

Description of soils and locations

1. Gregory Co.

(a) Boyd silty clay loam - silty clay surface soil overlying clay shale occurring on slightly undulating topography.

Cropping history and previous management

Largely corn and oats with very limited use of soil improvement practices.

Discussion and interpretation of results

No significant responses were obtained at the 5% confidence level.

Table 21. Comparative Efficiency of Nitrogen Carriers for Corn

Treatment Pounds Per Acre N	P_2O_5	K_2O	Source of Nitrogen	Yield Bushels per acre
0	0	0	none	53.0
40	0	0	Anhydrous Ammonia	56.0
40	0	0	Ammonium Nitrate	56.0
40	40	0	Ammonium Nitrate	59.8
80	0	0	Anhydrous Ammonia	63.4
80	0	0	Ammonium Nitrate	59.9
80	40	0	Anhydrous Ammonia	54.5
80	40	0	Ammonium Nitrate	61.0
80	40	0	Urea	56.8
L.S.D. at 5% confidence level				10.2

Objectives of experiment

Determine the effect of fertilizer treatment and the efficiency of various nitrogen carriers on the yield of corn.

Description of soil and location

1. Turner Co.

(a) Trent silt loam - a moderately well drained soil developed from loess.

Cropping history and past management

The cropping system followed was largely corn and oats with limited use of fertility improving practices.

Discussion and interpretation of results

There were no measurable differences in the efficiency of the different nitrogen carriers for increasing corn yields.

There were increases in corn yield due to fertilizer treatments but these increases were small because of the limitations imposed by drought.